

ARCHIVES OF PEDIATRICS

A MONTHLY DEVOTED TO THE
DISEASES OF INFANTS AND CHILDREN

JOHN FITCH LANDON, M.D., Editor

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Beneficial Effect of Addition of Various Amino Acids
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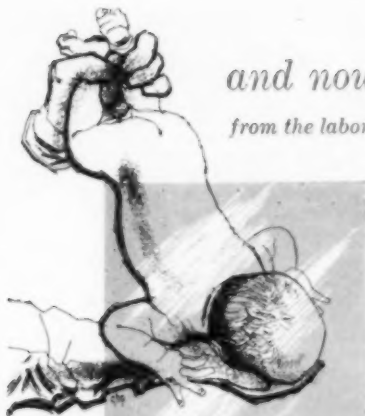
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The Results of Decapsulation of the Kidneys for Nephritis in Children with Report of a Case in a Child of Twenty-six Months.

EDWIN E. GRAHAM, M.D. 103

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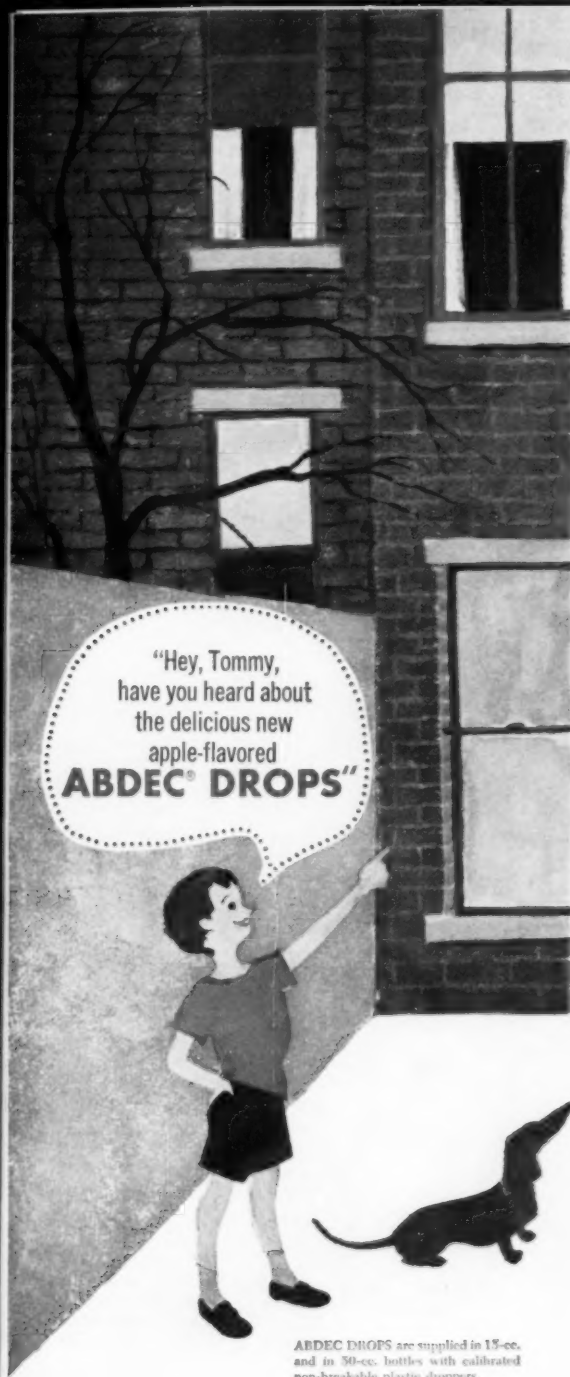


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THE PROTEIN EFFICIENCY OF VARIOUS PABLUMS AND THE BENEFICIAL EFFECT OF ADDITION OF VARIOUS AMINO ACIDS AND VITAMIN B₁₂*

BARNETT SURE, PH. D.

Fayetteville, Ark.

The infant cereal, Pablum, fortified with vitamins and minerals and precooked is used extensively in infant nutrition. While it is realized that this cereal is used with milk, infants allergic to milk must necessarily use it as a gruel without milk. In addition, Albanese and associates¹ have recently demonstrated that certain infants manifest symptoms of malnutrition because they do not utilize efficiently the lysine of milk. The supplementation of the diets of such infants with poor appetites with 100 mg./Kg/day of L-lysine was associated in most instances with marked increase in daily nitrogen retention and body weight and with significant increases in blood protein levels.

Since there are now available on the market several types of Pablum, it was thought of interest to investigate their protein efficiency and the biological effect of addition of several essential amino acids, such additions having been previously demonstrated to markedly improve the nutritive value of the proteins of cereal grains². Another objective of this investigation was to determine the possible function of vitamin B₁₂ as a supplement to the various

*From the Department of Agricultural Chemistry, University of Arkansas, Fayetteville. With the technical assistance of L. Easterling, J. Dowell, and M. Crudup. Published with the approval of the Director of the Arkansas Agricultural Experiment Station; aided by grants from E. I. du Pont de Nemours & Co., and The National Institutes of Health.

Pablums when fortified with certain amino acids. The manufacturers** were very generous in supplying first the Old Mixed Cereal which was followed by an Improved Mixed Cereal, and later by the Oatmeal, Barley, and Rice Pablums.

EXPERIMENTAL

This study was conducted on the Wistar strain albino rat. The animals were 28 to 30 days old when started on experiments and weighed 50 gm. to 54 gm. each. The sexes were equally divided. There were twelve animals in each group. The experimental period was ten weeks. The Mixed Cereal Pablums, the Oatmeal and Barley Pablums were fed at 8 per cent protein levels and the Rice Pabulum, because of its low nitrogen content at a 5 per cent protein level. The rations also contained, percentagewise, 2 of cellulose for roughage; 4 of Sure's salts No. 1¹¹; 7 of vegetable shortening; 2 of cod liver oil; 1 of wheat germ oil; and the rest Cerelese (glucose). The fat-soluble vitamins A, D, and E were supplied by the cod liver oil and wheat germ oil in the rations. The following crystalline components of the vitamin B complex were administered in Petri dishes six times weekly with double doses on Saturdays to each animal separately from the ration: 25 µg. each of thiamine, riboflavin, pyridoxine, and niacin; 150 µg. calcium pantothenate, 3 mg. p-aminobenzoic acid, 6 mg. choline chloride, and 1 mg. inositol. Folic acid was not added, since it is synthesized in the intestinal tract of the rat. Vitamin B₁₂ was not added routinely but only in special types of experiments to study its physiological function in increasing growth and protein efficiency. The results are expressed as gains in body weight per gram of protein intake, which indicates the protein efficiency ratio (PER).

Table 1. Protein Content of Various Pablums

| Type of Pabulum | Protein Content % |
|---------------------------------|----------------------|
| Pabulum (Mixed Cereal) | 14.9 |
| Pabulum (Improved Mixed Cereal) | 15.8 |
| Pabulum (Oatmeal) | 14.2 |
| Pabulum (Barley) | 11.0 |
| Pabulum (Rice) | 6.2 |

The results of this investigation are summarized in Tables 1 to 8, inclusive. The protein content of the various Pablums is given in Table 1 and the ingredients used in Table 2. It will be

**Mead-Johnson & Company, Evansville, Indiana.

noted from Table 3 that the Improved Mixed Cereal Pablum produced the greatest growth and the highest PER, which is probably due to the fact that its protein nutritive value has been improved by the incorporation of soybean flour, which is absent in

Table 2. Ingredients in Various Pablums

| Type of Pablum | Ingredients* |
|--------------------------------|--|
| Pablum (Mixed Cereal) | wheat flour (Farina), oatmeal, yellow corn meal, wheat germ, powdered alfalfa leaf, and dried yeast. |
| Pablum (Improved Mixed Cereal) | Oatmeal, wheat flour (Farina), corn meal, soybean flour, dried yeast, wheat germ, and barley malt. |
| Pablum (Oatmeal) | Oatmeal and dried yeast. |
| Pablum (Barley) | Barley flour and dried yeast. |
| Pablum (Rice) | Rice flour. |

* All the Pablums are fortified with tribasic calcium phosphate, sodium chloride, thiamine hydrochloride, riboflavin and reduced iron.

the older Mixed Cereal and in the other Pablums. The Barley Pablum and the Mixed Cereal Pablum are of equal protein value and the Oatmeal Pablum is next in value to the Improved Mixed Cereal. In spite of the fact that the Rice Pablum, because of its

Table 3. The Protein Efficiency of Various Pablums
Average results per animal

| Ration No. | Type of ration | Per cent in ration | Protein in ration | Gains in body weight | Total food intake | Protein intake | Protein efficiency ratio ¹ |
|------------|--------------------------------|--------------------|-------------------|----------------------|-------------------|----------------|---------------------------------------|
| | | % | g. | gm. | gm. | gm. | |
| 1 | Pablum (Mixed Cereal) | 53.7 | 8.0 | 59.3 | 639.1 | 51.0 | 1.16 ± 0.05 ² |
| 9 | Pablum (Improved Mixed Cereal) | 50.6 | 8.0 | 94.0 | 701.0 | 56.1 | 1.67 ± 0.04 |
| 15 | Pablum (Oatmeal) | 56.8 | 8.0 | 89.5 | 825.7 | 66.1 | 1.25 ± 0.07 |
| 22 | Pablum (Barley) | 72.7 | 8.0 | 60.8 | 662.9 | 53.0 | 1.25 ± 0.06 |
| 27 | Pablum (Rice) | 60.7 | 5.0 | 28.4 | 494.0 | 24.7 | 1.25 ± 0.05 |

1 Gains in body weight per gram of protein intake.

2 Standard deviation of the means.

low protein content of only 6.2 per cent, produced the lowest gains in body weight, its PER equalled the Barley and the Mixed Cereal types, which is understandable because the rice proteins have the highest biological value of the cereal grains³.

Influence of Vitamin B₁₂ and Amino Acids Additions to the Various Pablums. Since the biological value of the proteins in the Improved Mixed Cereal is superior to the older product of Mixed Cereal Pabulum, the response to amino acids additions in the former were naturally less.

Table 1. Influence of Additions of Various amino acids and Vitamin B₁₂ to the Proteins in Pabulum (Mixed Cereal) on Growth and Protein Efficiency. 8 per cent protein in rations.

| Ration No. | Type of ration | average results per animal | | | | |
|------------|--|----------------------------|----------|-------------------|----------------|---------------------------------------|
| | | Gains in body weight | | Total food intake | Protein intake | Protein efficiency ratio ¹ |
| | | increase | increase | | | |
| | | gm. | % | gm. | gm. | % |
| 1 | Pabulum (Mixed Cereal) PNC | 59.3 | - | 638.1 | 51.0 | 1.16 ±.062 |
| 2 | PNC + 0.2% L-lysine | 85.2 | 43.7 | 683.3 | 54.7 | 1.56 ±.07 |
| 3 | PNC + 0.2% L-lysine + 0.1 µg B ₁₂ /animal/day | 100.7 | 69.8 | 647.7 | 51.8 | 1.94 ±.06 |
| 4 | PNC + 0.2 % L-lysine + 0.2% DL-methionine | 103.1 | 73.7 | 642.5 | 51.3 | 2.01 ±.08 |
| 5 | PNC + 0.2% L-lysine + 0.2% DL-threonine | 117.8 | 98.6 | 817.2 | 65.4 | 1.80 ±.07 |
| 6 | PNC + 0.2% L-lysine + 0.2% DL-threonine + 0.1 µg B ₁₂ /animal/day | 123.3 | 107.9 | 780.2 | 62.4 | 1.98 ±.08 |
| 7 | PNC + 0.2% L-lysine + 0.2% DL-threonine + 0.2% DL-methionine | 131.3 | 121.4 | 740.9 | 59.3 | 2.22 ±.09 |
| 8 | PNC + 0.2% L-lysine + 0.2% DL-threonine + 0.2% DL-methionine + 0.1 µg B ₁₂ /animal/day | 121.4 | 106.7 | 711.9 | 57.0 | 2.13 ±.08 |

1 Gains of body weight per gram of protein intake.

2 Standard deviation of the means.

In the case of the *Mixed Cereal Pabulum* there were significant increased growth and PER following addition of 0.2 per cent L-lysine, i.e., 43.7 per cent increased growth and 34.5 per cent increase in PER (ration 2). The further supplementation with 0.1 µg. of vitamin B₁₂/animal/day resulted in 26.1 per cent additional increased growth and 32.7 per cent increase in PER (ration 3). Similar responses were obtained when the daily dose of vitamin B₁₂ was replaced with 0.2 per cent DL-methionine (ration 4). The increased growth due to the addition of 0.2 per cent DL-threonine to 0.2 per cent L-lysine can be accounted by the increased food intake; therefore, no increase in PER was secured (ration 5). However, this combination of amino acids fortified with vitamin B₁₂ resulted in a pronounced increase in protein efficiency ratio. The optimum increase in body weight and PER was obtained by supplementation of 0.2 per cent L-lysine with 0.2 per cent DL-threonine and 0.2 per cent DL-methionine (ration 7). The addi-

SURE: Beneficial Effect of Various Amino Acids & Vitamin B₁₂ 85

tion of vitamin B₁₂ to the latter ration apparently was superfluous, since it resulted in a slight inhibitory effect in growth and protein efficiency ratio, associated with reduced food intake.

Table 5. Influence of Additions of Various Amino Acids and Vitamin B₁₂ to the Proteins in Pabulum (Improved Mixed Cereal) on Growth and Protein Efficiency. 8 per cent protein in rations.

| Average results per animal | | | | | | | |
|----------------------------|--|----------------------|------|-------------------|----------------|---------------------------------------|------|
| Ration No. | Type of ration | Gains in body weight | | Total food intake | Protein intake | Protein efficiency ratio ¹ | |
| | | Increase | | | | | |
| | | gm. | % | gm. | gm. | % | |
| 9 | Pabulum (Improved Mixed Cereal)/FMC | 94.0 | - | 703.0 | 56.1 | 1.67 ±.06 ² | - |
| 10 | FMC + 0.2% L-lysine | 117.5 | 25.0 | 764.7 | 61.2 | 1.92 ±.08 | 15.1 |
| 11 | FMC + 0.2% L-lysine + 0.1 µg B ₁₂ /animal/day | 132.6 | 41.0 | 825.6 | 66.0 | 2.01 ±.11 | 20.6 |
| 12 | FMC + 0.2% L-lysine + 0.2% DL-threonine | 124.8 | 32.8 | 701.9 | 56.2 | 2.06 ±.10 | 22.1 |
| 13 | FMC + 0.2% L-lysine + 0.2% DL-threonine + 0.2% DL-methionine | 142.3 | 50.3 | 727.4 | 58.2 | 2.43 ±.11 | 45.5 |
| 14 | FMC + 0.2% L-lysine + 0.2% DL-threonine + 0.4% DL-methionine | 160.8 | 71.1 | 798.3 | 63.9 | 2.51 ±.13 | 50.3 |

1 Gains in body weight per gram of protein intake.

2 Standard deviation of the means.

In the case of *Improved Mixed Cereal Pabulum* there was no noteworthy response to threonine in presence of lysine (ration 12) but the addition of 0.2 per cent to 0.4 per cent DL-methionine to

Table 6. Influence of Additions of Various amino acids and Vitamin B₁₂ to the Proteins in Pabulum (Oatsmeal) on Growth and Protein Efficiency. 8 per cent protein in rations. Average results per animal.

| Ration No. | Type of Ration | Gains in body weight | | Total food intake | Protein intake | Protein efficiency ratio ¹ | |
|------------|---|----------------------|------|-------------------|----------------|---------------------------------------|------|
| | | Increase | | | | Increase | |
| | | gm. | % | gm. | gm. | % | |
| 15 | Pabulum (Oatsmeal) PO | 89.5 | - | 825.7 | 66.1 | 1.35 ±.04 ² | - |
| 16 | PO + 0.2% L-lysine | 122.5 | 36.9 | 876.0 | 70.1 | 1.75 ±.06 | 29.7 |
| 17 | PO + 0.2% L-lysine + 0.1 µg vitamin B ₁₂ /animal/day | 159.2 | 77.6 | 973.8 | 77.9 | 2.05 ±.08 | 51.9 |
| 18 | PO + 0.2% L-lysine + 0.2% DL-threonine | 129.2 | 44.3 | 851.1 | 68.1 | 1.90 ±.05 | 40.8 |
| 19 | PO + 0.2% L-lysine + 0.2% DL-threonine + 0.1 µg B ₁₂ /animal/day | 151.3 | 69.0 | 877.9 | 70.2 | 2.15 ±.07 | 59.2 |
| 20 | PO + 0.2% L-lysine + 0.2% DL-threonine + 0.2% DL-methionine | 131.2 | 46.6 | 717.0 | 57.4 | 2.29 ±.12 | 69.6 |
| 21 | PO + 0.2% L-lysine + 0.2% DL-threonine + 0.4% DL-methionine | 154.0 | 72.1 | 764.7 | 61.2 | 2.51 ±.13 | 85.9 |

1 Gains in body weight per gram of protein intake.

2 Standard deviation of the means.

this ration was followed by significant increased growth and PER (rations 13 and 14).

Pablum (Oatmeal). The addition of 0.2 per cent L-lysine to the basal ration resulted in 36.9 per cent increased growth and 29.7 per cent increase in PER (ration 16) and the supplementation of this ration with vitamin B₁₂ was followed by 40.9 per cent additional growth and 22.2 per cent further increase in PER (ration 17). The addition of 0.2 per cent DL-threonine apparently was not needed to the Pablum (Oatmeal) cereal (ration 18) because it resulted in an inhibitory effect on growth and protein utilization, which, however, was counteracted by supplementation with vita-

Table 7. Influence of Additions of Various Amino Acids and Vitamin B₁₂ to the Proteins in Pablum (Barley) on Growth and Protein Efficiency. 8 per cent protein in rations. Average results per animal.

| Ration No. | Type of ration | Gains in body weight | | Total food intake | Protein intake | Protein efficiency ratio ¹ | |
|------------|---|----------------------|-------|-------------------|----------------|---------------------------------------|------|
| | | Increase | | | | Increase | |
| | | gm. | % | | | gm. | % |
| 22 | Pablum (Barley) PB | 60.6 | - | 662.9 | 53.0 | 1.35 ±.03 ² | - |
| 23 | PB + 0.2% L-lysine | 124.6 | 104.9 | 610.4 | 64.6 | 1.92 ±.07 | 66.9 |
| 24 | PB + 0.2% L-lysine + 0.1 µg B ₁₂ /animal/day | 121.0 | 100.0 | 709.9 | 63.2 | 1.91 ±.07 | 66.1 |
| 25 | PB + 0.2% L-lysine + 0.2 % DL-threonine | 116.1 | 90.9 | 696.7 | 55.7 | 2.09 ±.10 | 81.7 |
| 26 | PB + 0.2% L-lysine + 0.2% DL-threonine + 0.2% DL-methionine | 126.4 | 104.5 | 702.0 | 56.2 | 2.21 ±.09 | 92.1 |

1 Gains in body weight per gram of protein intake.

2 Standard deviation of the means.

min B₁₂ (ration 19). The addition of 0.2 per cent DL-threonine and 0.4 per cent DL-methionine to 0.2 per cent L-lysine (ration 21) produced the optimum protein utilization.

Pablum (Barley). The addition of 0.2 per cent L-lysine to this basal ration was accompanied by marked increased growth, 104.9 per cent, and significant increase in PER, 66.9 per cent. The optimum increase in PER was obtained by the combination of 0.2 per cent L-lysine, 0.2 per cent DL-threonine and 0.2 per cent DL-methionine, an increase of 92.1 per cent.

Pablum (Rice). Since it was previously demonstrated that animals on proteins in rice do not respond to single administration of either L-lysine or DL-threonine but to a combination of these two amino acids, and since rice is low in protein content, it was decided to supplement the Pablum (Rice) cereal with 0.4 per cent L-lysine and 0.3 per cent DL-methionine, which resulted in an enormous increase in body weight, 171.8 per cent and in a large increase in PER, 98.3 per cent (ration 28). The greatest response

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to the minute daily dose of 0.1 µg of vitamin B₁₂/animal/day was secured as a supplement to the Pablum (Rice), i.e., 315.5 per

Table 8. Influence of Additions of Various amino acids and Vitamin B₁₂ to the Protein 1: Pablum (Rice) on Growth and Protein Efficiency. 5 per cent protein in rations. Average results per animal.

| Ration No. | Type of Ration | Gain in body weight | | Total food intake | Protein intake | Protein efficiency ratio | |
|------------|--|---------------------|-------|-------------------|----------------|--------------------------|------|
| | | Increase | | | | Increase | |
| | | gm. | % | gm. | gm. | | % |
| 27 | Pablum (Rice) PR | 28.4 | - | 494.0 | 24.7 | 1.15 | 2.04 |
| 28 | PR + 0.4% L-lysine + 0.3% DL-threonine | 77.2 | 171.8 | 675.3 | 33.8 | 2.28 | 2.11 |
| 29 | PR + 0.4% L-lysine + 0.3% DL-threonine + 0.1 µg B ₁₂ /animal/day | 110.0 | 315.5 | 805.5 | 40.3 | 2.93 | 2.14 |
| 30 | PR + 0.4% L-lysine + 0.3% DL-threonine + 0.5 % DL-methionine | 116.0 | 306.9 | 790.9 | 39.5 | 2.94 | 2.15 |
| 31 | PR + 0.4% L-lysine + 0.3% DL-methionine + 0.5% DL-methionine + 0.1 µg B ₁₂ /animal/day | 101.7 | 268.7 | 725.1 | 36.2 | 2.90 | 2.13 |

1. Gain in body weight per gram of protein intake.

2. Standard deviation of the means.

cent increased growth and 154.8 per cent increase in protein efficiency (ration 29). The increased growth and increase in PER due to vitamin B₁₂ alone was 143.7 per cent and 56.5 per cent respectively. Similar results were obtained by substituting the vitamin B₁₂ with 0.5 per cent DL-threonine (ration 30). The addition of vitamin B₁₂ to ration 30 resulted in a negative response.

DISCUSSION

In 1950 Briggs, Hill and Giles⁴ showed that in all plant rations for chicks, vitamin B₁₂ has a sparing action on methionine and choline requirements. The fact that in this study a minute dose of vitamin B₁₂ was able to replace 0.2 per cent DL-methionine in several Pablum cereal rations, indicates that this vitamin functions in methionine synthesis, probably by methylation of homocystine⁵. In a previous publication in this journal (September 1952) it was pointed out that, if in large scale production of amino acids the cost could be reduced to an extent that it becomes economical for further enrichment of flours, cereal grains and cereal food products derived therefrom, we could anticipate large scale reduction of malnutrition in this country and abroad. For infants allergic to milk and for those who are unable to utilize lysine efficiently in milk formulas, it would seem advisable to incorporate lysine and methionine or, if economical, lysine and vitamin B₁₂ in the Pablum cereals.

Such amino acid enriched Pablums might also be indicated in geriatric nutrition for many aged people who are also allergic to milk and whose defective dentition requires a soft and nutritious source of proteins.

Since an economical industrial production of L-lysine monohydrochloride by a fermentation process has just been announced⁶ which promises to be as inexpensive as methionine, it may be possible to enrich flours, cereals and cereal products without increased cost to the consumer, which is the practice in the case of vitamin-enriched breads.

Flodin has recently discussed The Philosophy of Amino Acid Fortification of Foods⁷. Amino acid fortification of cereal foods may be also of significant benefit in maternal diets during pregnancy when a protein intake of about 85 gm. a day, chiefly of high quality, is considered desirable for good health of both mother and infant. The latest dietary surveys indicate that many of the pregnant women in this country do not receive an adequate supply of proteins for optimum welfare^{8, 9, 10}. These studies disclosed that the average daily intake of proteins during pregnancy was only about 66 grams. Such a low protein intake is critical and impairs the health of both mother and offspring. It often results in serious injuries that are difficult to correct in the short time prior to delivery. Some of the accompanying symptoms are anemia, loss of weight, anorexia, dizziness and marked fatigue.

It would be of considerable clinical interest to investigate in communities of low income level where the pregnant women derive a large proportion of their proteins from cereal grains, if their breadstuffs enriched with lysine and methionine or with lysine and vitamin B₁₂ had any influence on lactation and welfare of the infant.

SUMMARY

A study was made of the relative biological values of the proteins in several types of Pabulum and of the influence of addition of vitamin B₁₂ and three essential amino acids, namely, L-lysine, DL-methionine, and DL-threonine.

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ACCIDENTAL INOCULATION WITH POLIOMYELITIS VIRUS. W. F. T. McMath. (*Lancet*, 1:702-703, April 2, 1955). A laboratory technician was hospitalized on Nov. 11, 1954. His duties included the necropsy of animals dying after inoculation with poliomyelitis virus. On Nov. 1, he was removing the spinal cord from a monkey that had become paralyzed and had died after repeated intramuscular inoculation of a tissue-culture of propagated type 2 strain of poliomyelitis virus. The patient sustained a small abrasion of a finger with a bone spicule from the vertebral column. He was given gamma globulin 15 ml. (1.5 gm.) intramuscularly on the same day, and was well until Nov. 9, when he complained of headache and lumbar pain. The following day he also had pain and tenderness of abdominal muscles. On admission he had a temperature of 102° F., slight neck stiffness, and a positive Kernig's sign. The neck stiffness cleared up the next day, but the tenderness and spasm of abdominal and hamstring muscles continued for another week. The complement fixation antibody investigations on serum taken on the 3rd and 28th days of the illness did not lend support to a diagnosis of recent systemic infection with poliomyelitis virus, but during the illness there was weakness of the extensor muscles of the fingers of both hands. His further progress was uneventful. Poliomyelitis was not epidemic in the district; and it is reasonable to assume that the patient contracted poliomyelitis by infection through the accidental scratch.—*J.A.M.A.*

DERMATITIS
A STUDY IN BIOLOGICAL AND CHEMICAL CONTROL
OF AMMONIA "DIAPER RASH"

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In a previous publication Brown, Tyson, and Wilson¹ reported their studies concerning bacteriological examination of wet diapers, soiled diapers, and swab cultures taken from 80 babies having rash in the diaper area. Southworth² appears to be the first to point out the importance of ammonia as a factor in regional dermatitis. At a later date Cooke³ reported the isolation from urine of *B. ammoniagenes* which he named and considered to be etiologic in ammonia dermatitis.

However, the ammonia producing organism we isolated most frequently was *B. proteus* which produces ammonia much more rapidly than either *B. ammoniagenes* or some strains of *Ps. pyocyanea*.

The use of quaternary ammonia compounds for the prevention of ammonia dermatitis has been reported by Benson and Slobody⁴ using *B. ammoniagenes* as the test organism.

In an effort to throw more light on the etiology of ammonia dermatitis, we considered it might be worthwhile to make comparative studies of diaper fabric impregnated with dilutions of several antiseptics used in the diaper laundry industry against ammonia producing organisms of fecal origin and others which were shown to be present by our previous bacteriological studies of diaper rash and which undoubtedly contribute to the infection occurring at such times.

The following five products were used: phenylmercuric acetate—3 per cent (P.M.A.S.), Diaparene and Teramine quaternaries, RH #3104* (70 per cent quaternary), and Lull-Done** reported by Rapp⁵. The test organisms used by us were *Proteus vulgaris*, *Proteus mirabilis*, *B. ammoniagenes*, *Ps. pyocyanea*, *Micrococcus aureus*, and *Streptococcus hemolyticus*.

*RH #3104 was supplied by Rohm & Haas Company through the courtesy of William E. Botwright.

**Said to inactivate urease by its anti-enzyme action so that Urea is not broken down to ammonia.

Since there has been discussion concerning the use of a single test, i.e., zone of inhibition, on the premise that there is interference with quaternaries by Agar in the Federal Department of Agriculture Agar-Plate Test, it was decided to use two additional tests, namely ammonia inhibition and germicidal tests.

Briefly, the tests were conducted as follows: All products were diluted within a range beginning at 1:500 to 1:5000, inclusive. RH #3104 containing 70 per cent quaternary was diluted to contain a 25 per cent concentration before making the test dilutions. The initial dilution of Lull-Done supplied as a powder was made by dissolving 1.0 gram in 500 ml. with distilled water. Two sets of all dilutions were made, one with distilled water and the other in a solution of zinc silicofluoride (Sour), at a concentration usually used as a rinse in commercial diaper laundries for removing soaps and neutralizing alkalies. This was considered to be important, since we have found that sour may have a slightly adverse effect upon the germicidal action of antiseptics, and we wished to determine to what extent this might occur. Birdseye fabric was cut into circular patches 20 mm. in diameter. The patches were strung on cotton thread, 80 patches to a thread, placed in bottles to simplify subsequent handling, and then autoclaved.

Each group of patches was placed into 50 ml. of each of the 60 dilutions of the compounds under study; they were agitated for seven minutes at room temperature, after which they were suspended clothes-line fashion and allowed to dry.

For the Agar-Plate tests one patch from each dilution (from 2 to 4 patches to a petri dish) was covered with 20 ml. of melted agar containing 0.1 ml. of overnight broth culture of the test organism, the zones being measured after 24 hours of incubation at 37°C.

In the germicidal tests one patch from each dilution was placed in a separate sterile flat-bottomed screw-capped vial 20 mm. inside diameter.

It was found that patches of this size absorb 0.2 ml. of liquid without flooding; so 0.2 ml. of saline containing the same concentration of test organism as used in the Agar-Plate Test was added directly to each patch with a sterile long tipped micro-burette without contaminating the neck or side of the vial with the test organism. The test organism was allowed to remain in contact with each test patch for a half hour, this being considered the minimum

period which one might expect a diaper to remain upon a baby. Immediately the 30-minute time period had elapsed, 5.0 ml. of nutrient broth was added to each vial, all vials being incubated for 48 hours at 37°C.

Growth of the test organisms indicated the particular dilution of

TEST ORGANISM: *Proteus vulgaris*

| | ANTISEPTIC | Dil. Used For Impregnating Of Fabric in Thousands | | | | | |
|-----------------|-------------------|---|---|---|-----|----|---|
| | | 0.5 | 1 | 2 | 3 | 4 | 5 |
| Agar-Plate Test | PMAS no sour | 4 | 2 | 2 | 0.5 | F. | 0 |
| | PMAS sour | 4 | 1 | 1 | F. | F. | 0 |
| | DIAPARENE no sour | 0 | 0 | 0 | 0 | 0 | 0 |
| | DIAPARENE sour | 0 | 0 | 0 | 0 | 0 | 0 |
| | RH 3104 no sour | 0 | 0 | 0 | 0 | 0 | 0 |
| | RH 3104 sour | 0 | 0 | 0 | 0 | 0 | 0 |
| | TERAPHINE no sour | 0 | 0 | 0 | 0 | 0 | 0 |
| | TERAPHINE sour | 0 | 0 | 0 | 0 | 0 | 0 |
| | LULL DONE no sour | 0 | 0 | 0 | 0 | 0 | 0 |
| | LULL DONE sour | 0 | 0 | 0 | 0 | 0 | 0 |

Zones of Inhibition: width of zone in mm. 0 = none, F. = faint.

| | | | | | | | |
|-----------------|-------------------|---|---|---|---|---|---|
| Germicidal Test | PMAS no sour | - | - | - | - | - | - |
| | PMAS sour | - | - | - | - | - | - |
| | DIAPARENE no sour | + | + | + | + | + | + |
| | DIAPARENE sour | + | + | + | + | + | + |
| | RH 3104 no sour | + | + | + | + | + | + |
| | RH 3104 sour | + | + | + | + | + | + |
| | TERAPHINE no sour | + | + | + | + | + | + |
| | TERAPHINE sour | + | + | + | + | + | + |
| | LULL DONE no sour | + | + | + | + | + | + |
| | LULL DONE sour | + | + | + | + | + | + |

+ = growth, - = no growth.

| | | | | | | | |
|----------------------|-------------------|-------|-------|-------|-------|-------|-------|
| NH ₃ Test | PMAS no sour | C.I. | C.I. | C.I. | C.I. | C.I. | 6-1/2 |
| | PMAS sour | C.I. | C.I. | C.I. | C.I. | C.I. | C.I. |
| | DIAPARENE no sour | 8-1/2 | 3 | 3 | 3 | 3 | 3 |
| | DIAPARENE sour | C.I. | C.I. | 5-1/2 | 5 | 5 | 5 |
| | RH 3104 no sour | 3 | 3 | 3 | 3 | 3 | 3 |
| | RH 3104 sour | C.I. | 5-1/2 | 4-1/2 | 4-1/2 | 4-1/2 | 4-1/2 |
| | TERAPHINE no sour | 3 | 3 | 3 | 3 | 3 | 3 |
| | TERAPHINE sour | C.I. | 5-1/2 | 4-1/2 | 4-1/2 | 4-1/2 | 4-1/2 |
| | LULL DONE no sour | 5-1/2 | 4-1/2 | 3 | 3 | 3 | 3 |
| | LULL DONE sour | C.I. | C.I. | C.I. | 10 | 8 | 7 |

C.I. = Complete Inhibition. Numbers = Hours Ammonia was Inhibited.

In the untreated fabric control, ammonia was produced in 2-1/2 hours.

Time period allowed for Ammonia formation: 48 hours.

antiseptic which was not effective. No growth indicated the effective dilution of the germicides.

For the ammonia inhibition tests five patches from each of the 60 dilutions representing five thicknesses of fabric, the usual thickness of a folded diaper covering a baby's skin, were placed in a

TEST ORGANISM: *Proteus mirabilis*

Agar-Plate Test

| ANTISEPTIC | | Dil. Used For Impregnating Of Fabric in Thousands | | | | | |
|------------|---------|---|-----|----|---|---|---|
| | | 0.5 | 1 | 2 | 3 | 4 | 5 |
| PMAS | no sour | 6 | 3.5 | F. | 0 | 0 | 0 |
| | sour | 5 | 3 | F. | 0 | 0 | 0 |
| DIAPARENE | no sour | 0 | 0 | 0 | 0 | 0 | 0 |
| | sour | 0 | 0 | 0 | 0 | 0 | 0 |
| PH 3104 | no sour | 0 | 0 | 0 | 0 | 0 | 0 |
| | sour | 0 | 0 | 0 | 0 | 0 | 0 |
| TERAMINE | no sour | 0 | 0 | 0 | 0 | 0 | 0 |
| | sour | 0 | 0 | 0 | 0 | 0 | 0 |
| LULL DONE | no sour | 0 | 0 | 0 | 0 | 0 | 0 |
| | sour | 0 | 0 | 0 | 0 | 0 | 0 |

Zones of Inhibition: width of zone in mm.. 0 = none, F. = faint.

Germicidal Test

| | | | | | | | |
|-----------|---------|---|---|---|---|---|---|
| PMAS | no sour | - | - | - | - | - | - |
| | sour | - | - | - | - | - | - |
| DIAPARENE | no sour | + | + | + | + | + | + |
| | sour | + | + | + | + | + | + |
| PH 3104 | no sour | + | + | + | + | + | + |
| | sour | + | + | + | + | + | + |
| Teramine | no sour | + | + | + | + | + | + |
| | sour | + | + | + | + | + | + |
| LULL DONE | no sour | + | + | + | + | + | + |
| | sour | + | + | + | + | + | + |

+ = growth, - = no growth.

NH₃ Test

| | | | | | | | |
|-----------|---------|--------|-------|-------|--------|--------|-------|
| PMAS | no sour | C.I. | C.I. | C.I. | C.I. | C.I. | C.I. |
| | sour | C.I. | C.I. | C.I. | C.I. | C.I. | C.I. |
| DIAPARENE | no sour | 4-1/2 | 4-1/2 | 4-1/2 | 4 | 4 | 4 |
| | sour | C.I. | 30 | 12 | 11-1/2 | 10 | 6 |
| PH 3104 | no sour | 4-1/2 | 4-1/2 | 4 | 4 | 4 | 4 |
| | sour | C.I. | C.I. | 27 | 16 | 12-1/2 | 11 |
| TERAMINE | no sour | 4-1/2 | 4 | 4 | 3-1/2 | 3-1/2 | 3-1/2 |
| | sour | 11-1/2 | 10 | 6 | 5 | 5 | 5 |
| LULL DONE | no sour | 10 | 6 | 4-1/2 | 4 | 4 | 4 |
| | sour | C.I. | C.I. | C.I. | C.I. | 20 | 18 |

C.I. = Complete Inhibition. Numbers = Hours Ammonia was inhibited.

In the untreated fabric control, ammonia was produced in 3 hours.

Time period allowed for Ammonia formations 48 hours.

sterile screw-capped vial 20 mm. in diameter. To all vials, including a control containing untreated fabric, was added an identical volume of previously filtered sterilized urine containing a suitable volume of overnight growth of test organism. It was necessary to determine by experiment beforehand the volume of each organism

required to produce ammonia within a suitable time period since *B. ammoniagenes* required more time than the two strains of *B. proteus* used.

TEST ORGANISM: *B. ammoniagenes*

| ANTISEPTIC | | Dil. Used For Impregnating Of Fabric In Thousands | | | | | |
|------------|---------|---|-----|------|------|-----|------|
| | | 0.5 | 1 | 2 | 3 | 4 | 5 |
| PMAS | no sour | 22 | 17 | 13 | 12 | 11 | 8 |
| | sour | 20 | 15 | 11 | 10 | 9 | 7 |
| DIAPARENE | no sour | 12 | 10 | 4 | 3 | 2.5 | 2.25 |
| | sour | 11 | 10 | 3.5 | 2.5 | 2 | 1.5 |
| RH 3104 | no sour | 5 | 4.5 | 3 | 2.5 | 2 | 1 |
| | sour | 5 | 4 | 2.5 | 1.75 | 1.5 | 0.75 |
| TERAMINE | no sour | 5 | 4.5 | 1.75 | 1 | 0.5 | 0 |
| | sour | 5 | 3 | 1 | F. | 0 | 0 |
| LULL DONE | no sour | 0 | 0 | 0 | 0 | 0 | 0 |
| | sour | 0 | 0 | 0 | 0 | 0 | 0 |

Zones of Inhibition: width of zone in mm.. 0 = none, F. = faint.

| ANTISEPTIC | | Germicidal Test | | | | | |
|------------|---------|-----------------|---|---|---|---|---|
| | | 0.5 | 1 | 2 | 3 | 4 | 5 |
| PMAS | no sour | - | - | - | - | - | - |
| | sour | - | - | - | - | - | - |
| DIAPARENE | no sour | - | - | - | - | - | - |
| | sour | - | - | - | - | - | - |
| RH 3104 | no sour | - | - | - | - | - | - |
| | sour | - | - | - | - | - | - |
| TERAMINE | no sour | - | - | - | - | - | - |
| | sour | - | - | - | - | - | + |
| LULL DONE | no sour | + | + | + | + | + | + |
| | sour | + | + | + | + | + | + |

+ = growth, - = no growth.

| ANTISEPTIC | | H ₂ Test | | | | | |
|------------|---------|---------------------|------|--------|------|------|--------|
| | | C.I. | C.I. | C.I. | C.I. | C.I. | C.I. |
| PMAS | no sour | C.I. | C.I. | C.I. | C.I. | C.I. | C.I. |
| | sour | C.I. | C.I. | C.I. | C.I. | C.I. | C.I. |
| DIAPARENE | no sour | C.I. | C.I. | C.I. | C.I. | C.I. | C.I. |
| | sour | C.I. | C.I. | C.I. | C.I. | C.I. | C.I. |
| RH 3104 | no sour | C.I. | C.I. | C.I. | C.I. | C.I. | C.I. |
| | sour | C.I. | C.I. | C.I. | C.I. | C.I. | C.I. |
| TERAMINE | no sour | C.I. | C.I. | C.I. | C.I. | C.I. | C.I. |
| | sour | C.I. | C.I. | C.I. | C.I. | C.I. | C.I. |
| LULL DONE | no sour | C.I. | C.I. | 14-1/2 | 14 | 14 | 13-1/2 |
| | sour | C.I. | C.I. | C.I. | C.I. | C.I. | C.I. |

C.I. = Complete Inhibition. Numbers = Hours Ammonia was Inhibited. In the untreated fabric control, ammonia was produced in 12 hours.

Time period allowed for ammonia formation: 48 hours.

The plastic caps used on the vials for the ammonia inhibition tests contained a tubular receptacle into which a pledget of cotton was plugged so that it protruded down about a half inch into the vial. The purpose of the cotton was to hold by absorption the liquid indicator which changed from yellow to red as soon as ammonia rising from the test patches came in contact with the cotton.

Observations for the presence of ammonia were made at the regular intervals.

Duplicate determinations were made in many instances.

TEST ORGANISM: *Ps. pyocyanea*

| Agar-Plate Test | ANTISEPTIC | Dil. Used For Impregnating Of Fabric In Thousands | | | | | |
|-----------------|-------------------|---|----|---|---|---|---|
| | | 0.5 | 1 | 2 | 3 | 4 | 5 |
| | | 1.5 | F. | | | | |
| | P.M.A.S. no sour | 0 | 0 | 0 | 0 | 0 | 0 |
| | sour | 1 | F. | 0 | 0 | 0 | 0 |
| | DIAPARENE no sour | 0 | 0 | 0 | 0 | 0 | 0 |
| | sour | 0 | 0 | 0 | 0 | 0 | 0 |
| | RH 3104 no sour | 0 | 0 | 0 | 0 | 0 | 0 |
| | sour | 0 | 0 | 0 | 0 | 0 | 0 |
| | TERAMINE no sour | 0 | 0 | 0 | 0 | 0 | 0 |
| | sour | 0 | 0 | 0 | 0 | 0 | 0 |
| | LULL DONE no sour | 0 | 0 | 0 | 0 | 0 | 0 |
| | sour | 0 | 0 | 0 | 0 | 0 | 0 |

Zones of Inhibition: width of zone in mm.. '0' = none, F. = faint.

| Germicidal Test | | width of zone in mm.. | | | | | |
|-----------------|-------------------|-----------------------|----|---|---|---|---|
| | | 0.5 | 1 | 2 | 3 | 4 | 5 |
| | | 1.5 | F. | | | | |
| | P.M.A.S. no sour | - | - | - | - | - | + |
| | sour | - | - | + | + | + | + |
| | DIAPARENE no sour | + | + | + | + | + | + |
| | sour | + | + | + | + | + | + |
| | RH 3104 no sour | + | + | + | + | + | + |
| | sour | + | + | + | + | + | + |
| | TERAMINE no sour | + | + | + | + | + | + |
| | sour | + | + | + | + | + | + |
| | LULL DONE no sour | + | + | + | + | + | + |
| | sour | + | + | + | + | + | + |

+ = growth, - = no growth.

DISCUSSION

Agar-Plate and Germicidal Studies. Examination of the tables reveals that Lull-Done failed to produce zone of inhibition and did not kill any of the test organisms.

P.M.A.S. and the three quaternary ammonium compounds were all effective against *B. ammoniagenes* with the exception that Teramine began to lose its effect at the 1:4000 and 1:5000 dilutions in the Agar-Plate and Germicidal studies, respectively. The size of the zones produced by P.M.A.S against this organism as compared with those produced by the quaternaries is worthy of note.

In the case of *M. aureus* and *Streptococcus hemolyticus*, P.M.A.S. was superior, being effective in all dilutions in both

studies. Diaparene and RH #3104 began to lose their effect at approximately the same dilutions with respect to these two or-

TEST ORGANISM: *Micrococcus aureus*

| ANTISEPTIC | | Dil. Used For Impregnating Of Fabric In Thousands | | | | | |
|------------|---------|---|------|-----|------|------|------|
| | | 0.5 | 1 | 2 | 3 | 4 | 5 |
| PHAS | no sour | 12 | 10 | 9 | 7 | 6.5 | 5 |
| | sour | 11 | 9 | 8 | 7 | 5.5 | 5 |
| DIAPARENE | no sour | 4 | 3 | 2 | 1 | 1 | 0.75 |
| | sour | 3.5 | 2.5 | 1.5 | 1 | 0.5 | 0.5 |
| RH 3104 | no sour | 3 | 2.25 | 2 | 1.5 | 0.75 | 0.5 |
| | sour | 2 | 2 | 1.5 | 0.75 | 0.5 | 0.25 |
| TERAMINE | no sour | 3 | 2 | 0.5 | F. | 0 | 0 |
| | sour | 2.75 | 1 | F. | 0 | 0 | 0 |
| LULL DONE | no sour | 0 | 0 | 0 | 0 | 0 | 0 |
| | sour | 0 | 0 | 0 | 0 | 0 | 0 |

Zones of Inhibition: width of zone in mm. 0 = none, F. = faint.

| | | | | | | | | |
|-----------------|-----------|---------|---|---|---|---|---|---|
| Antiseptic Test | PHAS | no sour | - | - | - | - | - | - |
| | | sour | - | - | - | - | - | - |
| | DIAPARENE | no sour | - | - | - | - | - | - |
| | | sour | - | - | - | + | + | + |
| | RH 3104 | no sour | - | - | - | - | + | + |
| | | sour | - | - | - | - | + | + |
| | TERAMINE | no sour | - | - | - | + | + | + |
| | | sour | - | - | - | + | + | + |
| | LULL DONE | no sour | + | + | + | + | + | + |
| | | sour | + | + | + | + | + | + |

+ = growth, - = no growth.

ganisms. Teramine was least effective, since it required stronger dilutions to produce zones of inhibition or have bactericidal effect. This was particularly true against *Streptococcus hemolyticus*, since dilutions weaker than 1:500 were of no value.

The three quaternary ammonium compounds failed to have any effect in any of the dilutions upon *Ps. pyocyanea*, *P. mirabilis*, and *P. vulgaris* in either study. However, P.M.A.S. displayed definite bactericidal results against these three organisms, particularly the two strains of *B. proteus*.

Ammonia Inhibition Studies. At this point of the study it became apparent that some factor, not previously encountered, was occurring in the reactions. It will be noted that inhibition of ammonia became more evident in all instances where the fabric had been treated with sour. Evidently there are two functions at work

when sour is used with antiseptics. The first is that sour does interfere slightly with antiseptics from a germicidal standpoint; note

TEST ORGANISM: *Streptococcus hemolyticus*

| | ANTISEPTIC | Dil. Used For Impregnating Of Fabric In Thousands | | | | | |
|-----------------|-------------------|---|------|------|------|------|---|
| | | 0.5 | 1 | 2 | 3 | 4 | 5 |
| Agar-Plate Test | PMAS no sour | 11.5 | 9 | 6.25 | 4.25 | 3.75 | 3 |
| | sour | 10 | 8 | 5 | 4 | 2.5 | 2 |
| | DIAPARENE no sour | 2 | 1 | F. | 0 | 0 | 0 |
| | sour | 1.5 | 0.75 | 0 | 0 | 0 | 0 |
| | RH 3104 no sour | 3 | 2.25 | 1 | 0.5 | F. | 0 |
| | sour | 2.75 | 1.5 | 0.75 | F. | 0 | 0 |
| | TERANINE no sour | F. | 0 | 0 | 0 | 0 | 0 |
| | sour | F. | 0 | 0 | 0 | 0 | 0 |
| | LULL DOME no sour | 0 | 0 | 0 | 0 | 0 | 0 |
| | sour | 0 | 0 | 0 | 0 | 0 | 0 |

Zones of Inhibition: width of zone in mm., 0 = none, F. = faint.

| | | | | | | | |
|-----------------|-------------------|---|---|---|---|---|---|
| Germicidal Test | PMAS no sour | - | - | - | - | - | - |
| | sour | - | - | - | - | - | - |
| | DIAPARENE no sour | - | - | - | + | + | + |
| | sour | - | - | + | + | + | + |
| | RH 3104 no sour | - | - | - | + | + | + |
| | sour | - | - | - | + | + | + |
| | TERANINE no sour | - | + | + | + | + | + |
| | sour | + | + | + | + | + | + |
| | LULL DOME no sour | + | + | + | + | + | + |
| | sour | + | + | + | + | + | + |

+ = growth, - = no growth.

particularly its effect upon P.M.A.S. when the test organism was *Ps. pyocyanea*. The second is that sour appears to aid in retarding or completely inhibiting ammonia. This is apparent in every instance where the antiseptic alone was ineffective.

It has been known, as far back as 1893, that traces of certain metals have an effect upon bacteria; von Nageli coined the term *oligodynamic* action from the Greek words "oligos" meaning small, and "dynamis" meaning power, to form a word meaning powerful in small quantities. In this instance the sour used in these studies was zinc silicofluoride, so that we have a metal present which caused delay of ammonia production. It is also possible that the fluoride may be a contributing factor.

P.M.A.S. completely inhibited ammonia production by *P. mirabilis* in all dilutions in both the absence and presence of sour. Its performance against *P. vulgaris* was almost identical, the excep-

tion being in the 1:5000 dilution without sour, where ammonia was retarded four hours beyond the time it occurred in the control fabric. It will be seen that with sour, ammonia was completely inhibited in the same dilution.

Concerning the three quaternaries and Lull-Done, none of these products completely inhibited ammonia in the absence of sour. However, when sour was present, Lull-Done completely inhibited ammonia at 1:3000 against *P. mirabilis* and at 1:2000 against *P. vulgaris*. Diaparene and RH #3104 performed about equally but were less effective than Lull-Done. Teramine was generally least effective.

Reference to the chart concerning *B. ammoniagenes* indicates that all products prevent ammonia formation in all dilutions when sour was used. Four of the products accomplished this without sour, Lull-Done being the exception.

SUMMARY

This investigation has shown the phenylmercuric acetate type of antiseptic to be generally the most effective. Of the three quaternary ammonium compounds, Diaparene and RH #3104 appear to be about equal in their performance, Teramine being least effective.

Lull-Done revealed no bactericidal qualities against the six organisms used in the study. However, it inhibits development of ammonia at the laundry use concentration of approximately 1:1300. It, therefore, appears there are two modes of operation by which ammonia and other undesirable odors such as the sulphur odors characteristic of the mercaptans are inhibited.

One mode is by bactericidal action, as shown in chart on *B. ammoniagenes*; the other by interference with bacterial enzymes, namely, the enzyme urease which decomposes urea to produce ammonia.

Evidence has been presented that the combination of an antiseptic and an enzyme inhibitor as in the case of phenylmercuric acetate and Lull-Done "assisted" by zinc silicofluoride controls the production of ammonia by bacteria.

It would seem that diapers treated in this manner with a proper concentration of antiseptic, never greater than 1:4000, should reduce the incidence of ammonia dermatitis.

We wish to thank the members of The National Institute Diaper Services for the grant which made this study possible.

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ORAL BCG VACCINATION WITH MASSIVE REPEATED DOSES IN INITIAL TUBERCULOSIS OF CHILDREN. C. Gernez-Rieux, A. Breton, A. Tacquet and M. Fabre. (*Semaine hôp. Paris*, 37:3907-3917, Dec. 10, 1955).

One hundred thirteen children between the ages of 18 months and 6 years hospitalized for initial tuberculosis were vaccinated with the Calmette-Guérin bacillus. Every week 100 mg. of the vaccine was administered, and this dose was repeated 10 or 20 times. All patients showed good tolerance to the BCG, with exception of the fact that in 37% no weight gain occurred during the period of administration. Radiological improvement of the tuberculous lesions was noted in 52 of the children during or soon after the period of administration. The improvement was more apt to occur in patients with pulmonary lymphadenopathy and consequent disordered ventilation than in other forms of initial tuberculous, such as simple lymphadenopathy, lymphopneumopathy with bronchial fistula, and bronchogenic or hematogenic alveolitis. Combined BCG and antibiotic treatment (two or all of the three best-known agents) gave a greater number of good results (53.8%) than either antibiotic treatment alone (41.%) or BCG vaccination alone (30.8%). However, discrete, transitory aggravation of the lesions was observed radiologically in three patients during the period of treatment. One of these reactions was accompanied by a phlyctenular keratoconjunctivitis. More serious aggravation was observed in two patients nine and seven months after the vaccinal period. One was accompanied by pericardial effusion and the other by the presence of tubercle bacilli in the liquid obtained from gastric intubation. — J.A.M.A.

COMMUNICATION

THE RESPONSIBILITIES OF THE MEDICAL PROFESSION IN THE USE OF X-RAYS AND OTHER IONIZING RADIATION

STATEMENT BY THE UNITED NATIONS SCIENTIFIC COMMITTEE
ON THE EFFECTS OF ATOMIC RADIATION

New York.

1. The United Nations General Assembly, being aware of the problems in public health that are created by the development of atomic energy, established a Scientific Committee on the Effects of Atomic Radiation. This Committee has considered that one of its most urgent tasks was to collect as much information as possible on the amount of radiation to which man is exposed today, and on the effects of this radiation. Since it has become evident that radiation due to diagnostic radiology and to radio-therapy constitutes a substantial proportion of the total radiation received by the human race, the Committee considers it desirable to draw attention to information that has been obtained on this subject.

2. Modern medicine has contributed to the control of many diseases and has substantially prolonged the span of human life. These results have depended in part on the use of radiation in the detection, diagnosis and treatment of disease. There are, however, few examples of scientific progress that are not attended by some disadvantages, however slight. It is desirable, therefore, to review objectively the possible present or future consequences of increased irradiation of populations which result from these medical applications of radiation.

3. It is now accepted that the irradiation of human beings, and particularly of their germinal tissues, has certain undesirable effects. While many of the somatic effects of radiation may be reversible, germinal irradiation normally has an irreversible and, therefore, cumulative effect. Any irradiation of the germinal tissues, however slight, thus involves genetic damage which may be small but is nevertheless real. For somatic effects there may however be thresholds for any irreversible effects, although if so these thresholds may well be low.

4. The information so far available indicates that the human

race is subjected to natural radiation,¹ as well as to artificial radiation due to its medical applications, to atomic industry and its effluents and to the radioactive fall-out from nuclear explosions. The Committee is aware of the potential hazards that such radiation involves, and it is collecting and examining information on these subjects.

5. The amount of radiation received by the population for medical purposes is now, in certain countries, the main source of artificial radiation and is probably about equal to that from all natural sources. Moreover, since it is given on medical advice, the medical profession exercises responsibility in its use.

6. The Committee appreciates fully the importance and value of the correct medical use of radiation, both in the diagnosis of a large number of conditions, in the treatment of many such diseases as cancer, in the early mass detection of conditions such as pulmonary tuberculosis, and in the extension of medical knowledge.

7. Moreover, it appreciates fully the contribution of the radiological profession, through the International Commission on Radiological Protection² in recommending maximum permissible levels of irradiation. As regards those whose occupation exposes them to radiation, the establishment of these levels depends on the view that there are doses which, according to present knowledge, do not cause any appreciable body injury in the irradiated individual; and also on the consideration that the number of people concerned is sufficiently small for the genetic repercussions upon the population as a whole to be slight. Whenever exposure of the whole population is involved, however, it is considered prudent to limit the dose of radiation received by germinal tissue from all artificial sources to an amount of the order of that received from the natural background radiation.

8. It appears most important therefore that medical irradiations of any form should be restricted to those which are of value and importance, either in investigation or in treatment, so that the

1 The radiation due to natural sources has been estimated to cause between 70 and 170 millirem of irradiation to the gonads per annum in most parts of certain countries in which it has been studied, although higher values are found locally in some areas. See the reports "The hazards to man of nuclear and allied radiations" published by the United Kingdom Medical Research Council in June 1956, in which also the millirem is defined; and from information submitted to the Committee.

2 See the report of the International Commission on Radiological Protection (published in the *British Journal of Radiology*—Supp. 6, of December 1954—in the *Journal français d'électro-radiologie*—No. 10, of October 1955—etc. and revised in 1956).

irradiation of the population may be minimized without any impairment of the efficient medical use of radiation.

9. The Committee is consequently anxious to receive information through appropriate governmental channels as to the methods and the extent by which such economy in the medical use of radiation can be achieved, both by avoiding examinations which are not clearly indicated and by decreasing the exposure to radiation during examinations, particularly if the gonads, or the foetus during pregnancy lie in the direct beam of radiation. It seeks, in particular, to obtain information as to the reduction in radiation of the population which might be achieved by improvements in instrument design, by fuller training of personnel, by local shielding of the gonads, by choosing appropriately between radiography and fluoroscopy, and by better administrative arrangements to avoid any necessary repetition of identical examinations.

10. The Committee also seeks the co-operation of the medical profession to make possible an estimate of the total radiation received by the germinal tissue of the population before and during the child-bearing age. It considers it to be essential that standardized methods of measurement, of types at present available, should be widely used to obtain this information and it emphasizes the value of adequate records, maintained by those using radiation medically, by the dental profession, and by the responsible organizations in allowing such radiation exposure to be evaluated. The Committee is convinced that information of this type will make it possible to decrease the total medical irradiation of the population while preserving and increasing the true value of the medical uses of radiation.

EXOMPHALOS. A. A. Cunningham. (*Arch. Dis. Childhood*, 31:144-151, April 1956).

Exomphalos is a rare condition in which there is a congenital malformation of the umbilical cord, alone or combined with a defect of the supraumbilical region of the abdomen, and through which the viscera herniate into a sac covered by amniotic membrane and peritoneum. Exomphalos includes conditions described as omphalocele, amniocoele, amniotic hernia, and hernia into the umbilical cord. In view of the poor results experienced in the surgical treatment of cases of large exomphalos at the author's hospital, it was decided in 1948 to try conservative treatment using absolute alcohol dressings in conjunction with an antibiotic. The successful results obtained demonstrate that conservative treatment is worthy of a trial.—J.A.M.A.

PEDIATRICS AT THE TURN OF THE CENTURY

From time to time, the Archives, which was the first Children's Journal in the English language, will reprint contributions by the pioneers of the specialty over fifty years ago. It is believed that our readers will be interested in reviewing such early pediatric thought.

THE RESULTS OF DECAPSULATION OF THE KIDNEYS FOR NEPHRITIS IN CHILDREN WITH REPORT OF A CASE IN A CHILD OF TWENTY-SIX MONTHS.*

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In a careful study of American and foreign literature for decapsulation of the kidneys for nephritis, the writer has been impressed with the fact that very few cases in children have been reported, the majority of operations having been performed upon adults. In this paper the results of decapsulation for nephritis only will be considered. Pain in the kidney, movable kidney, and surgical affections of the kidney will not be dealt with.

It seems already proven that such cases are suitable for operation and this paper considers only cases of nephritis uncomplicated by such conditions. The following cases have been found in the literature.

Case 1. Mary B., twelve years old; edema of feet, legs and eyes; some peritoneal dropsy; previous history of measles, mumps and scarlet fever as a child; scanty secretion of urine varying from 10 ounces to 2 ounces in twenty-four hours; albumin, $\frac{1}{2}$ to 1 per cent; urea, 3.59 per cent; sediment typical of parenchymatous nephritis; death in five days after operation. Case would probably have died if not operated on.

Case 2. Francis H. J., thirteen years old; scarlet fever at four years with edema of face and legs during convalescence, symptoms persisting for two weeks; never strong after scarlet fever; was known to have nephritis for perhaps nine months before operation. Had a systolic murmur; edema of extremities; feet cold and clammy; at time of operation, albumin, $\frac{1}{2}$ per cent;

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fine and coarse granular casts with fat and renal cells. Operation on April 12, both kidneys decapsulated. On May 28, albumin, $\frac{3}{10}$ per cent; a rare hyaline and finely granular cast. October 15, no albumin; specific gravity, 1.013; no casts; had slight edema of face and hands two months previous for twenty-four hours. Child evidently much improved since operation.

Case 3. Boy nine and one-half years old; had measles, diphtheria and typhoid, not scarlet fever; edema present; urine smoky; acid, 1.010; albumin, $\frac{1}{8}$ to $\frac{1}{4}$ per cent; many hyaline and granular casts; blood; renal cells; few fatty and epithelial casts. Tapped three times, with death nineteen days after operation.

Case 4. Child five years old; chronic parenchymatous nephritis for three years, following an attack of measles. Child not cured by medical treatment. Operated on February 15, 1902, with decapsulation of both kidneys. February 4, 1903, no casts; no red or white cells in urine; albumin, 0.05 per cent. April 16, 1904, specific gravity, 1.021; no albumin; no sugar; no casts. Child pale but in good health.

Case 5. Case of a boy thirteen years old. In the first report, no improvement was noticed, the case being reported shortly after operation. Marked improvement two months after operation. Doing very well seven months after operation. Two years after operation, in good health; no casts, and only a trace of albumin in the urine.

Case 6. Child nine years old with severe, well advanced chronic parenchymatous nephritis. Patient had been watched for some years; symptoms had slowly but progressively grown worse; anasarca extreme; albumin, $\frac{1}{2}$ to $2\frac{1}{2}$ per cent; operation in September. At first there was slight improvement; albumin diminished to 1 per cent. Casts remained numerous; anasarca never improved. Child remained in hospital three or four weeks, then went home, after which the albumin returned to the same amount as before operation. Dr. Andrews considers the case not improved by operation.

Case 7. Child, aged nine years, had scarlet fever at four years. Nephritis with albuminuria and general anasarca at the age of five. Symptoms disappeared rapidly under treatment; has had two relapses with more or less complete recovery. Chronic parenchymatous nephritis steadily growing worse under best medical care; marked anasarca and ascites; average daily quantity of urine

22 ounces, loaded with albumin and casts. In one week, after first operation on right kidney only, anasarca entirely disappeared, and quantity of urine greatly increased. Two months later, the left kidney was operated on. Child is apparently in good health. It lived in a much improved condition for over a year after the operation, when she took cold, acquired another attack of acute nephritis and died in the course of a couple of weeks. Autopsy was refused.

Case 8. A boy ten years old, with chronic nephritis; albumin, 1.6 per cent; numerous hyaline, granular and epithelial casts; paracentesis abdominis performed seven times in the six months preceding the operation. His general health remained good for one year and nine months after decapsulation, when the symptoms of nephritis returned. He improved under treatment. Ten weeks later another acute exacerbation of his nephritis occurred, and a second operation for decapsulation was performed with apparently no benefit. Two months later, another relapse, and one month later, still another relapse. No report as to death or recovery.

Case 9. A boy eight years old; had measles in infancy; diphtheria seven months before operation. Known to have nephritis two months. No improvement under medical treatment for one month. Specific gravity, 1.040; albumin, 1.5 per cent; hyaline, fatty, granular and epithelial casts. Right kidney decapsulated. Death fifteen days later from uremia.

Case 10. A boy nine and one-half years, with advanced parenchymatous nephritis, albumin, $\frac{1}{8}$ to $\frac{1}{3}$ per cent; urea, 5 to 9 grams in twenty-four hours; hyaline, granular and fatty casts. Patient steadily growing worse. Symptoms temporarily relieved by decapsulation. Death eighteen days after operation.

The history of my own case, *Case 11*, is as follows: Girl, aged twenty-six months; family history good; child was born at full term, raised on the breast and had good health until seventeen months of age, when she had a mild attack of scarlet fever. Three weeks later dropsy developed in face, hands and feet. This disappeared largely, after three weeks of treatment. Two weeks later, dropsy returned and, in spite of systematic and careful medical treatment, persisted. The urine at this period contained a large amount of albumin and many casts. Her condition grew gradually worse, and she was admitted to the Jefferson Hospital October 8, 1904.

On admission the child was pale and the extremities cold and bluish. She exhibited general anasarca, the face being so swollen that the tips of the eyelashes barely protruded. It was entirely impossible for her to open the lids, and there was peritoneal dropsy. Heart's action rapid; sounds are less distinct than normal; no cardiac murmur; lungs normal. Blood examination made October 9, showed erythrocytes, 3,180,000; leukocytes, 14,000; hemoglobin, 64 per cent; color index, 1 per cent; polynuclear, 89 per cent; small lymphocytes, 10 per cent; large lymphocytes, 1 per cent, and numerous poikilocytes.

She remained under my medical care for a week, and during this time a systematic use of hot baths, diaphoretics, diuretics, laxatives and a liquid diet failed to be of benefit; in fact, the child grew progressively worse, and during the forty-eight hours preceding operation showed distinct uremic symptoms. Death seemed imminent unless a radical change for the better should occur quickly. Dr. W. W. Keen was asked to see the child with the hope that a decapsulation of the kidneys might offer some chance of saving its life. The parents were informed that the child might die under the operation, and their consent being obtained, Dr. Keen operated with the assistance of Dr. Joseph Hearn on October 15, Dr. Keen operating upon the right kidney, while Dr. Hearn operated on the left. The edema of the back was so great as to obscure almost entirely the spines of the vertebra. Dr. Keen removed a small portion of the right kidney by transverse incision. Both kidneys were a dark purplish color and distinctly larger than normal. Both capsules were easily separated and pushed thoroughly forward anteriorly and posteriorly.

The child stood the operation remarkably well, chloroform being the anesthetic used. Twenty-four hours after the operation the child showed a most marked improvement, the dropsy was distinctly less in the face, arms and legs. The eyes could easily be opened, and the child was hungry. It was difficult to estimate the total quantity of urine passed in the twenty-four hours, the major portion of it being lost in the child's napkins.

On October 17, the patient was distinctly better; dropsy almost completely disappeared, and the child sleeps well. Three days after the operation the amount of urine voided was very distinctly increased. On the fourth, fifth and sixth days after decapsulation, the dropsy returned to a moderate extent, the child

became drowsy and evidently was not doing so well. Improvement then began, and, with the exception of the period when she was absent from the hospital, January 5 to 18, 1905, there has been no dropsy. Twelve days after the operation she had a slight attack of pulmonary congestion, which rapidly disappeared under treatment.

On October 31, a small, whitish patch was noticed on the conjunctiva. The child was sent to the out-patient ophthalmological department, and it was found, upon examination, that there were present whitish patches of degeneration in both foveal regions, similar to those of chronic albuminuric retinitis. She was discharged from the hospital January 5, 1905, in very good condition. On January 18 she was readmitted to the hospital with slight edema. She did not receive proper care at home. Under appropriate medical treatment and diet the child rapidly improved, has been in the hospital ever since and, to all external appearances, seems perfectly well.

Dr. Howard Hansell reports, on June 10, 1905, a thorough examination through the medicinally dilated pupil with the electric ophthalmoscope, during ether anesthesia, showing the circulation of the retina to be unchanged from the normal; no hemorrhages or edema to be found, and no pathological changes in the foveal regions.

The child seems perfectly well, is free from all dropsy, is not anemic and is bright and cheerful.

In the study of the subject of decapsulation of the kidneys, it seems advisable first to consider the method by which this operation is supposed to cure. Edebohls claims that a cure is largely brought about by the increased amount of arterial blood which the kidney receives after the operation, and claims to have found postmortem blood vessels of considerable size entering the kidney tissue, the development of such blood vessels being subsequent and dependent upon the decapsulation. Ziegler says: "When a portion of renal epithelia has been destroyed by a morbid process which spares the interstitial structures, the loss is in general, soon made good by regenerative proliferation of the remainder, and if the circulation is adequately maintained, the new epithelia presently become capable of carrying on secretory function."

Edebohls says: "Renal decapsulation is performed with the object in view of creating new and liberal supplies of arterial blood to the diseased kidney. The denuded kidney and its fatty

capsule are most liberally supplied with blood vessels. Both are brought together by the operation over the entire surface of the kidney, and new and large blood vessels form between the kidney and the surrounding fatty tissue. The normal capsule of the kidney forms a barrier, of course, to this new supply of blood made possible by a decapsulation."

If this increase of blood supply to the kidneys, which Edebohls claims to occur, actually does occur, then the increased amount of blood carried to the kidney should improve the circulation in the kidney, and assist in removing waste products. The portion of the kidney not diseased would take on an increased function, and the disease might be checked. It is a debatable question, however, whether the newly formed blood vessels going to the cortex from the fatty capsule are permanent. They are probably only temporary, and it is doubtful, therefore, how much increased blood supply is really carried to the kidney after decapsulation.

A factor which probably has considerable to do with the improvement which is noticed during the first few days after a decapsulation is the massage which the kidneys receive at the hands of the surgeon during the operation. It seems plausible to believe that this necessary manipulation temporarily relieves the congestion and inflammation which exists.

There is much, however, in the study of cases operated upon to lead one to believe that the factor which has most to do with the remarkable improvement that is sometimes noticed after decapsulation, is the relief of the kidney tension which is brought about by the removal of the capsule. Experimental decapsulation done on animals by W. H. Gifford seems to show that "there is a certain amount of intracapsular tension in undecapsulated kidneys, normal or with nephritis. There is an immediate increase in size of decapsulated kidneys, persisting up to one month at least, afterwards; a decrease to approximately normal size complete at the end of six months. The increase in size is due primarily to the increase in blood supply, possibly resulting from the removal of the capsule."

It is now, I think, universally admitted that the decapsulated kidney becomes enveloped in a much thicker capsule than existed previous to a decapsulation, in from three to four months after the operation. Where the kidneys have been really seriously damaged by nephritis, an improvement may be noticed for possibly a few months after the operation, and it seems easy to understand

how the improvement could continue after the formation of the new capsule, which, according to the studies of Dr. Johnson, of San Francisco, and others, seems positively to occur in a few months.

The favorable progress which is at times noted during the first few months following the operation takes place, in the opinion of the writer, before the new capsule is formed, and the improvement which has occurred during these first few months may, in certain cases, be sufficient to produce changes of a character that may be more or less permanent. This gain may continue progressively for perhaps some months after the capsule has been reproduced, and possibly be permanent. Wolff believes that the parenchyma of the kidney is never regenerated. The undiseased cells may hypertrophy and take on partially the function of the destroyed cells, but he does not believe that the old cells are replaced by new ones. However, the probabilities of new cell development seem certainly to be infinitely greater in children than in adults.

Evidence seems to be steadily accumulating against the acceptance of Edebohls' theory of increased blood supply in the kidney being the beneficial factor following the operation, and considerable testimony has accumulated pointing to the improvement being due to the relief of renal tension. Whether the latter is or is not true does not alter the fact that certain cases do improve in a most remarkable manner after the operation, and it is the duty of the physician to study these cases and select those suitable for operation. If it is possible to separate earlier the cases likely to result fatally from those where a favorable prognosis is probable, either etiologically, or by the history of the case, or by the urinary findings, an earlier operation might in these cases show a decided decrease in the total mortality.

Chronic interstitial nephritis associated with arterial sclerosis, perhaps with changes in the heart and liver, does not seem to the writer to offer much prospect of a cure from a decapsulation; the kidney condition in these cases is usually only a part of a general degenerative condition of the entire body. It is possible that a certain amount of temporary improvement in the kidney might follow an operation in these cases, but a permanent cure, or even a lengthening of life, does not seem to be at the most more than possible.

The removal of the kidney capsule in these cases may assist

in temporarily checking the sclerosis of the kidney, but the formation of the new capsule in a few months, and the impossibility of a complete cure effected during these months of new capsule formation, seem to argue against a permanent cure in this class of cases. It is, however, not always an easy matter to decide how much of the inflammation is parenchymatous, how much is diffuse, and how much interstitial.

A careful study of the cases operated upon seems to show that if the nephritis is of comparatively recent origin, the urinary evidences of the nephritis being, perhaps, only of some months' duration, and if under the best medical care the case is not improving but growing progressively worse and there is more or less renal insufficiency, in these acute or subacute cases, a rapid improvement may follow a decapsulation. The symptoms in some of the reported cases disappear as if by magic, and the urinary findings show such a marked improvement that there is no doubt that the operation, and the operation alone, is accountable for such improvement; and there is no reason why, in cases of this character, an occasional complete cure might not result. Marked uremic symptoms add greatly to the danger in these cases, and should cause one to give a very guarded prognosis.

A true nephritis is probably rarely, if ever, one-sided. In 500 autopsy records reported by Guiteras, in all nephritis was found to exist in both kidneys. It seems to be the growing practice, in view of this fact, to operate on both kidneys, although it is the general belief that an operation performed on one of the kidneys assists in the function performed by the other.

Just what part renal mobility plays in the symptoms of the child, it is difficult to say; probably it is a factor of very little importance. If this is true, it makes the successful cases in children all the more noteworthy, as the movable kidney associated with nephritis, albumin and casts in the urine, constitute a distinct class of cases in adults where the operation is followed by good results. In considering the question of mortality, Guiteras, after a careful investigation of 120 cases, gives the following results: 16 per cent, cured; 40 per cent, improved; 11 per cent, unimproved; 33 per cent, deaths. The mortality in chronic interstitial nephritis was 26 per cent; the mortality in chronic parenchymatous nephritis 25 per cent, and the mortality in chronic diffuse nephritis 75 per cent. Dr. A. R. Elliott of Chicago gives

the mortality in 76 cases as 47 per cent, including chronic parenchymatous nephritis, and chronic interstitial, the cases showing improvement as 34 per cent; unimproved 16 per cent; worse after operation 2.6 per cent, or a total of 65 per cent not favorably influenced. He is emphatic in his condemnation of the operation.

Both the mortalities of Guiteras and Elliott consist largely, if not entirely, of adult cases. When we come to consider the mortality in children, I find that the results are distinctly better, as is shown later in this paper.

It is important, when possible, to make a careful bacteriologic examination of the urine collected by catheterization of the ureters, for the bacteria present may decide the question of a decapsulation or a nephrotomy.

In considering this question of mortality, it is very important to remember that the large majority of cases reported are hospital cases, and it is just this class of cases where it is extremely difficult to continue careful, systematic and appropriate treatment, many of these children leaving the hospital to return to their homes, where proper treatment is often altogether impossible, and the possible cure, therefore, rendered extremely doubtful. This is well illustrated in my case, where the child did very well in the hospital, was allowed to go home, became rapidly worse and again quickly improved after its return to the hospital.

The mortality of Bright's disease, where there is disease of the fundus of the eye, is exceedingly high. Dr. G. F. Suker says: "It matters not what form of Bright's disease you may consider, the fundus lesions which are of paramount clinical significance are albuminuric retinitis, and neuroretinitis, with or without hemorrhages. This albuminuric retinitis is of the gravest prognostic importance, and that in an inverse proportion to the age of the patient. When present, irrespective of the stage or type of the Bright's disease (excluding the puerperal and scarlatinal types), the operation of decapsulation is absolutely contraindicated. Retinal changes frequently accompany chronic interstitial nephritis, next in frequency the parenchymatous and finally the diffuse variety of Bright's disease. Very seldom in a purely acute nephritis can a retinitis albuminurica be positively established (not including the puerperal or scarlatinal).

"Patients with albuminuric retinitis rarely live over two years after the retinitis is recognized. Decapsulation only hastens their

death, and has not saved a single life in this class of cases that I am aware of. Suker reports 20 cases of decapsulation with retinitis with twenty deaths."

It is a well-known fact that albuminuric retinitis is quite rare in children, and when present, is not nearly so grave a symptom as when present in the adult. Moreover, albuminuric retinitis is seldom seen in the acute forms of nephritis. The number of cases operated upon in children is too small as yet to be able to collect any data in regard to this point, and I have been unable to find any record of the exact percentage of cases of nephritis which show any evidences of albuminuric retinitis. It seems, however, to be rather in the child's favor that retinitis occurs less often than in the adult, and when it does occur, it is not so unfavorable. It probably points to the fact that the kidney lesions in the child are less likely to be associated with other lesions in the body, and hence decapsulation on a child may offer better chance of cure than an operation done in a similar case in an adult.

In my series of 11 cases, there were five deaths, or 45.4 per cent. Of these five deaths, Case 7, operated upon by Dr. C. H. Frazier, lived in a much improved condition for a year and died from an attack of acute nephritis. One case was distinctly improved by operation. There were four probable, or at least possible, complete cures, or 36.3 per cent, namely, Cases 2, 4, 5, and 11. Two cases were not improved. All of the cases would probably have died if not operated upon.

The form of nephritis most benefited by operation is the acute and subacute cases, but only those should be operated upon which are not doing well under appropriate medical treatment. The results in the chronic cases is not favorable. Regeneration of the kidney tissue in the child is more likely to occur, and the kidney lesions in the child are less likely to be complicated by other degeneration in other portions of the body, and hence, improvement possible in the first few months following decapsulation is more apt to be permanent in the child.

The eye ground changes are less significant in the child than in the adult.

It is important to collect statistics from private practice, as the results ought to be better than from cases in hospital practice.

DEPARTMENT OF ABSTRACTS

Conducted by

MICHAEL A. BRESCIA, M.D., NEW YORK

FORSYTH, C. C. and PAYNE, W. W.: FREE DIETS IN THE TREATMENT OF DIABETIC CHILDREN. (Archives of Disease in Childhood, 31:245, August 1956).

This survey of 100 diabetic children allowed "free diets" deals with the short-term aspects and also with the incidence of degenerative complications in those who have reached adult life. As the overall results of treatment have been as good as those obtained by clinics employing weighed diets, and, because of the psychological advantages and the better cooperation achieved, we believe that the use of a liberal diet will permit the best control in the greatest number of children.

Authors' Summary.

KWANTES, W. and JAMES, J. R. E.: HAEMOLYTIC STREPTOCOCCI ON THE NEONATAL UMBILICUS. (British Medical Journal, 4992: 576, Sept. 8, 1956).

Two outbreaks of group A streptococcal infection in maternity units are described. In each outbreak infants in the nursery were found to be carrying *Str. pyogenes* on the umbilicus. Carriage of *Str. pyogenes* was found to continue up to eight weeks. The umbilicus of the newborn infant might provide the means of transmitting streptococcal infection to the baby's own mother, as well as to other mothers and infants in the same maternity unit, to midwives, and, in domiciliary practice, to members of the household. Bacteriological examination of the umbilical swab may help to solve some epidemiological problems in puerperal sepsis.

Authors' Summary.

WOLMAN, I. J.: HEMATOLOGY OF LEAD POISONING IN CHILDHOOD. (American Journal Medical Sciences, 232:688, Dec. 1956).

The predominating hematologic lesion of lead poisoning is the faulty production of red cells and hemoglobin. The developing immature erythrocyte of the marrow is clearly much more susceptible to the noxious action of this intracellular poison than are the other marrow cells. The lead appears to depress the conversion of protoporphyrin into heme, and to hamper the formation of stroma in some of the red cells. It has not been feasible from the

recorded childhood cases to derive any generalizations with respect to significant relations between the severity of the blood changes, the level of blood lead in random test specimens, the age of the patients, the duration of the exposure, or the intensity of character of the constitutional symptoms exhibited.

AUTHOR'S SUMMARY.

KARZON, D. T.; BARRON, A. L.; WINKELSTEIN, W., JR. and COHEN, S.: ISOLATION OF ECHO VIRUS TYPE 6 DURING OUTBREAK OF SEASONAL ASEPTIC MENINGITIS. (Journal American Medical Association, 162:1298, Dec. 1, 1956).

An outbreak of aseptic meningitis, involving twenty-four cases, including seven hospitalized children, occurred in Holland, New York, population 500, in July 1955. The predominant clinical symptoms and signs included fever, frontal headache, signs of meningeal irritation, nausea and vomiting, generalized vague pains, minimal transitory muscle weakness, depression of superficial and deep tendon reflexes, and pharyngeal injection. All patients had a pleocytosis, predominantly lymphocytic. ECHO (enteric cytopathogenic human orphans) virus type 6 was isolated from seven stools and four pharyngeal specimens of seven hospitalized children. All seven hospitalized patients developed a neutralizing antibody response to ECHO virus type 6 beginning on the fifth day of illness. The antibody was still present after seven months.

The high virus recovery rate from stool and pharynx, the epidemiological data, the neutralizing antibody response during the course of the illness, and the demonstration of virus in the spinal fluid of patients are presented as evidence for establishing an etiological role for ECHO virus type 6 in seasonal aseptic meningitis.

M.A.B.

HAWORTH, J. C.: ADHESIVE STRAPPING FOR UMBILICAL HERNIA IN INFANT. CLINICAL TRIAL. (British Medical Journal, 500:1286, Dec. 1, 1956).

A clinical trial was conducted to determine the efficacy of adhesive strapping for umbilical hernias in infants. It was found that, while nearly all untreated umbilical hernias had resolved by 12 months of age if the protrusion was small, if the protrusion was more than one-quarter inch (6 mm.) in size, strapping greatly increased the cure rate. Strapping of large hernias before the baby is 6 months old is advocated. In this series of 100 cases the proportion of males to females was two to one.

AUTHOR'S SUMMARY.

NIELSEN, O. S.: HISTOLOGICAL CHANGES OF THE PYLORIC MYENTERIC PLEXUS IN INFANTILE PYLORIC STENOSIS. STUDIES ON SURGICAL BIOPSY SPECIMEN. (*Acta Paediatrica*, 45:636, Nov. 1956).

Biopsy specimens of pyloric muscles from 15 young infants operated on for congenital pyloric stenosis were submitted to histological examination. This revealed severe irreversible degeneration of the intramuscular ganglion cells in all cases. These cells were found to be highly chromatolytic or atrophic, and the ganglia presented varying degrees of glial proliferation. The stomachs of 8 infants, dead without clinical signs of pyloric stenosis, were submitted to similar histological examination for control. Here the intramuscular ganglion cells were normal.

The significance of this ganglion cell degeneration for the etiology and pathogenesis of congenital pyloric stenosis has been discussed together with the significance of the roentgenologically demonstrable disturbances of motility in the prepyloric area of individuals with cured congenital pyloric stenosis.

Author's Summary.

BAKWIN, H.: INFORMING THE PARENTS OF THE MENTALLY RETARDED CHILD. (*Journal Pediatrics*, 49:486, Oct. 1956.)

The parents should be told frankly, but with kindness, about the mental condition of their child. Certain offensive words like idiot, moron, cretin, mongol, and so on, should be avoided.

A few complimentary, laudatory words about the child help to lighten the blow. Discussion should be designed to allay guilt and feelings of rejection.

Topics which parents want to discuss are etiology, heredity, subsequent children, future development of the patient. The subject of institutional care should be approached carefully.

The parents should be assured of the continued interest of the physician.

Author's Summary.

HILL, R. D.: MASS THERAPY WITH PIPERAZINE ADIPATE IN THE CONTROL OF THREADWORM INFESTATIONS. (*British Medical Journal*, 5002:1156, Nov. 17, 1956).

The mass treatment with piperazine adipate of all the children aged 1 to 14 years on one of the Shetland Isles is described. The object was to rid them of threadworms. A total of 194 children were treated. A sample group of 50 children were examined by

anal swabs, and their mothers questioned about their symptoms before and after treatment. Before treatment 32 were found to be infested with threadworms. Two weeks after treatment all 30 who completed the course were free of infestation. Six months later 20 had been reinfested, but, one month after a second course of treatment, all were free again. There was also amelioration in symptoms, generally ascribed to threadworm infestation, with the notable exception of enuresis. Side-effects of treatment were few and unimportant.

It is concluded that mass treatment with piperazine adepate is effective in eradicating threadworm infestation in a community of children, but to prevent relapse, parents, particularly the mothers, must be treated at the same time. *Author's Summary.*

HYMAN, G. A. and REESE, A. B.: COMBINATION THERAPY OF RETINOBLASTOMA WITH TRIETHYLENE MELAMINE AND RADIOTHERAPY. (Journal American Medical Association, 162:1368, Dec. 8, 1956).

Because of the possibility of synergism between radiotherapy and triethylene melamine therapy, a study was commenced in January 1953 at the Columbia-Presbyterian Medical Center in which 50 children with retinoblastoma received combined therapy. This combination appeared to be both feasible and apparently successful in arresting retinoblastoma in a significant proportion of children with early disease. It was found that triethylene melamine could be administered safely to children in doses proportionately larger than those given to adults and that the route of choice was intramuscular. *Authors' Summary.*

ELLIS, F. H., JR. and DU SHANE, J. W.: PRIMARY MEDIASTINAL CYSTS AND NEOPLASMS IN INFANTS AND CHILDREN. (American Review of Tuberculosis and Pulmonary Diseases, 74:940, Dec. 1956).

Observations on 58 primary mediastinal cysts and neoplasms in infants and children have been reviewed. Symptoms were present in 35 (60 per cent) of the 58 patients. Symptoms were more commonly associated with teratomatous tumors, enterogenous anomalies, and with malignant lesions of all varieties rather than with any other type of mediastinal lesion. Neurogenic tumors and teratomatous tumors together represented more than 60 per cent of all of the cases. It was observed that vascular lesions and cystic hygromas occur more frequently in this group

of infants and children than in adults. There were no instances of mediastinal goiter, thymoma or coelomic cyst in contrast to the findings in adults. A malignant tumor was present in 14 (24 per cent) of the 58 patients.

Authors' Summary.

MACKENZIE, D. A. and MCKIM, J. S.: TREATMENT OF STAPHYLOCOCCAL EMPYEMA IN CHILDREN. (Canadian Medical Association Journal, 75:914, Dec. 1, 1956).

In summary, it is proposed that staphylococcal empyema be treated in the following manner:

1. Immediate intercostal catheter drainage with local anesthesia.
2. Application of low-pressure suction to the catheter.
3. Regular intrapleural instillation of antibiotics and of streptokinase and streptodornase solution followed by temporary interruption of suction.
4. Systemic administration of antibiotics in large doses along with ancillary measures as may be indicated.
5. Removal of the drainage tube when the following conditions prevail: (a) maintenance of a normal temperature; (b) cessation of drainage from the chest; (c) evacuation from the pleural space of pus, fluid and air.

Authors' Summary.

SCHATZKI, P. F.; MORTATI, S. G. and MCCAIN, W. G.: BRAIN TUMOR IN THE NEWBORN INFANT. (New England Journal Medicine, 255:908, Nov. 8, 1956).

A newborn male weighing 6 pounds and 10 ounces was somewhat hyperactive but without any apparent abnormality. Forty hours after delivery, respiratory distress and cyanosis were noted. The anterior fontanel was bulging and all suture lines were separated. A subdural puncture revealed frank blood bilaterally, and blood continued to drip from the needle marks, with some improvement. The infant was placed in an incubator and given vitamin K. However, the baby's condition became worse and he died 50 hours after birth. Autopsy, 10 hours later, revealed significant findings limited to the brain. There was a minimal occipital cephalhematoma. The entire surface of the cerebral hemispheres was covered by subarachnoid hemorrhage and the left lateral ventricle was distended with blood. The entire left temporal lobe and the middle portion of the parietal lobe were soft, necrotic and friable. There was marked cerebral edema. The lesion was identified microscopically as an ependymoblastoma.

M. A. B.

Hughes, E. L. and Cooper, C. E.: Some Observations on Headache and Eye Pain in a Group of Schoolchildren. (*British Medical Journal*, 4976:1138, May 19, 1956).

This work indicates that headache and eye pain related to tenderness of the first C.T.P. (cervical transverse process) tip are not uncommon in schoolchildren and may occur as early as 5 years of age. It is often thought by parents to be connected with the eyes and leads to the unnecessary wearing of spectacles by some children. It may persist for years, and results in the excessive consumption of aspirin. In a few children the condition cleared up spontaneously, while in the majority it responded rapidly to simple explanation and relaxation exercises. It is notable that most cases had tender areas in the neck muscles, which, together with the tenderness of the first C.T.P. tip, disappeared after this simple treatment. The region of the basiocciput seems to have received little investigation. Palpation of it, and of the adjoining neck muscles and cervical spine, does not usually form part of a routine examination. We think the region merits systematic examination so that we may know more of its contribution to and connection with the genesis of headache in childhood. *AUTHORS' SUMMARY.*

OBNEY, N.: HYDROCELES OF THE TESTICLE COMPLICATING INGUINAL HERNIAS. (*Canadian Medical Association Journal*, 75:733 Nov. 1, 1956).

About 5 per cent of inguinal hernias were associated with hydroceles of the testicle on the same side. Surgical treatment was 100 per cent effective in hydroceles uncomplicated by inguinal hernias, but only 91.3 per cent effective in hydroceles complicated by inguinal hernias. Large hydroceles obscure small inguinal hernias in at least 60 per cent of such combined cases. Lymphatic drainage along the spermatic cord must be avoided in order to prevent a post-herniorrhaphy hydrocele. Endothelial cells of the tunica vaginalis are capable of regenerating and causing a hydrocele to reform after combined operation for hernia and hydrocele.

Author's Summary.

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